REMARKS

Reconsideration of this application in view of the foregoing amendment and the following remarks is respectfully requested.

Allowable Subject Matter: Claim 7

The Examiner indicates that claim 7 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, and to include all of the limitations of the base claim and any intervening claims.

Objections: Claim 1

The Examiner objects to claim 1 by asserting that the detector "elements" must be a reference to the first and second layers, since no other antecedent basis is afforded for incident radiation giving rise to output signals.

In response, the applicants have amended claim 1 to replace the phrase "detector elements" with --first and second layers of diamond material--, so there is now proper antecedent basis for this final phrase.

35 U.S.C. 112, Second Paragraph: Claims 1-14

The Examiner has rejected claims 1-14 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention.

The Examiner asserts that it is not clear what distinction is afforded in claim 1 by reciting that the first and second layers are "optimised" when it should be apparent that optimisation is a matter of judgment upon which two practitioners need not agree. The Examiner applies the same assertion to claim 8.

In response, the applicants have amended claim 1 to substitute the phrase "optimised" with --designed--, as follows: --the first and second layers being ~~optimised~~ designed for the detection of different types of radiation or for the detection of different parameters of a particular type of radiation,--. The applicants have similarly amended claims 8 and 10, as appropriate.

It would have been obvious to one of ordinary skill in the art at the time the invention was made that the phrase "designed for" is functionally equivalent to "optimised for". One of ordinary skill in the art at the time the invention was made would have understood that "designed for" implies finality to the process of optimisation, thereby addressing the issue raised by the Examiner. As a result, no new matter has been added by the amendments to claims 1, 8 and 10.

Consequently, the applicants respectfully request the Examiner to withdraw the rejections of claims 1-14 under 35 U.S.C. 112, second paragraph.

35 U.S.C. 103(a) Rejections: Claims 1-6 and 8-14

The Examiner has rejected claims 1-6 and 8-14 under 35 U.S.C. 103(a) as allegedly unpatentable over Kraner (US 3,527,944 - filed October 10, 1968 - issued September 8, 1970) in view of Lu et al (US 5,773,830 - filed May 23, 1995 - issued June 30, 1998) and Kitaguchi et al (US 5,457,322 - filed March 29, 1994 - issued October 10, 1995).

The Examiner asserts that the first reference, US Patent No. 3,527,944 of Kraner, discloses a radiation detector for a single type of radiation (gamma radiation). In response, the applicants respectfully maintain that in Kraner, there is no disclosure of

detector layers of diamond material, nor of detector layers of different thickness. Kraner is silent on the relative thickness of the layers 42 and 44 shown in Figure 4, but the implication is that the layers (discrete detectors) 42 and 44 are identical.

The applicants maintain that the purpose of Kraner is to optimise the performance of the detector for complete Compton scattering of the photon, which is characterised by a series of successive reactions across the volume of the detector occurring within a very short time of one another as the photon moves at the speed of light. Kraner does this by separating the volume of the detector into two or more regions and looking for coincident events in the various regions, rejecting events not occurring in more than one or all regions. Thus, the key feature of Kraner's invention is to detect one specific property of one specific type of radiation (gamma radiation) and effectively to detect the same particle in each region of the detector simultaneously, these multiple measurements of the same particle then being considered as a confirmed single measurement. It can thus be appreciated that the teaching of Kraner has no relevance to the present invention which measures multiple types of radiation, or makes different types of measurement on the same type of radiation.

Reference can be made to column 1, line 66 to column 2, line 4 of Kraner, where the problem addressed by Kraner is set out, and column 2, lines 11 to 29, where the rationale of Kraner's invention is set out. In column 2, lines 48 to 56, it is made clear that the aim of Kraner is effectively the opposite of that of the present invention, in that Kraner is utilising multiple detector elements to eliminate or reduce unwanted signals from a detector for a single type of radiation, by detecting an interaction

between incident radiation and the multiple detector elements and utilising only those interactions which register on both detector elements. Thus, the applicants submit that Kraner teaches away from the present invention, which relates to the detection of multiple different types of radiation, or multiple characteristics of a single type of radiation, in a single detector, as recited by claim 1.

Accordingly, the applicants submit that there would be no motivation to look to Kitaguchi, which relates to the detection of different types of radiation.

Kitaguchi teaches the production of two detecting regions in a single semi-conductive layer, by forming pn junctions in the top and bottom surfaces of the layer (see column 2, line 66 to column 3, line 3 of Kitaguchi). The pn junctions have depletion regions, the thickness of which can be varied by varying an applied reverse bias voltage to each of the junctions (see abstract and column 3, lines 38 to 42). Thus, there is some similarity between the teaching of Kitaguchi and the present invention, in as much as Kitaguchi also provides a detector which can detect different types of radiation.

However, the structure and method of operation of Kitaguchi's detector are completely different from that of the present invention.

The body of Kitaguchi's device comprises a doped n or p type semi-conductor, with pn junctions formed by the diffusion of respectively p or n type dopants into the opposite surfaces. The depletion regions are then generated by applying a voltage across the pn junctions using a side contact to the body of the device as the common second contact. This approach is specific to doped semi-conductors such as silicon.

The diamond layers in the device of the present invention are not doped and are not dependent on the presence of depletion layers in any form. The applicants submit that the present invention is in fact preferable to that of Kitaguchi since it is physically simpler, and since the layout of the device and its functional parameters are set physically and are independent of the applied voltage bias. This means that the bias voltage applied to the detector of the present invention, as recited by claim 14, can then be optimised to control another parameter of the device, such as its sensitivity.

Apart from the above fundamental difference in the design and method of operation of the detector of Kitaguchi compared with that of the present invention, it can be noted that Kitaguchi specifically discounts providing a bonded multi-layer structure or one with a low resistance intermediate layer suitable for a common electrical contact (as is the case with the present invention recited by claim 1) on the basis that this reduces the sensitivity of the device to an unacceptable level. (See column 1, line 56 to column 2, line 52 and also column 4, lines 50 to 59 of Kitaguchi.) The described limitations are relevant to the semi-conductive material used by Kitaguchi but do not apply to diamond, and the detector of the present invention uses precisely the type of structure discounted by Kitaguchi. Thus, the applicants submit that the present invention is entirely opposite to the teaching of Kitaguchi.

Finally, with regard to Lu *et al*, this reference describes a CVD diamond deposition process for manufacturing a single layer radiation detector.

There is no reason to attempt to combine the teachings of Kitaguchi with Lu *et al*. The structure used by Kitaguchi cannot be replicated in diamond, while the

structure used by the present invention recited by claim 1, in diamond, is specifically discounted by Kitaguchi.

In the light of the above discussion, the applicants submit that there is no disclosure or suggestion in the cited prior art, either singly or in combination, of a single detector having first and second layers of diamond material of differing thickness with a common electrical contact, with the first and second layers being optimised for the detection of different types of radiation, or for the detection of different parameters of a particular type of radiation, as recited by claim 1.

Consequently, the applicants respectfully request the Examiner to withdraw the rejections of claims 1-6 and 8-14 over the prior art.

The foregoing amendment and remarks establish the patentable nature of all of the claims in the application, i.e., claims 1-14. No new matter has been added. Wherefore, early and favorable reconsideration and issuance of a Notice of Allowance are respectfully requested.

Respectfully submitted,

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